HITACHI

MODEL V-058G OSCILLOSCOPE

SERVICE MANUAL

Hitachi Denshi, Ltd.

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NOTICE

This Service Manual describes the most typical product of this model. If there are any specific differences between this Manual and the servicing unit, please contact Hitachi Denshi sales office in your area.

MODEL V-058G
OSCILLOSCOPE
Service Manual

1. SPECIFICATIONS

CRT

Type

3.5" screen with internal graticule

Approximate 1.5 kV acceleration potential

Screen type

P31 phosphor standard

Useful screen area

8 x 10 div

Graticule

Internal graticule.

Focussing

Possible

Trace rotation	Provided
Intensity control	Provided

VERTICAL DEFLECTION SYSTEMS (2 Identical Channels)

Bandwidth and Risetime;

DC to at least 5 MHz, 70 ns or less

DC to at least 2 MHz, 175 ns or less using x 5 gain

DC to at least 2 MHz and rise time 175 ns or less at magnifier extends.

The AC coupled lower -3 dB point is 10 Hz or less.

Deflection factor

50 mV/div to 2 V/div in 6 calibrated steps, in a 1-2-5 sequence.

The x 5 magnifier increases sensitivity of each deflection factor setting to 10 mV/div.

Accuracy

$\pm$3 % (+10 to +35 °C)

Additional error for magnifier $\pm$2 %

Display modes

CH1, CH2, DUAL

Input impedance

1 MΩ ±3 % in parallel with 40 pF ±4 pF

Maximum input voltage

100 V (DC + peak AC)

Input coupling

AC, GND, DC

HORIZONTAL DEFLECTION SYSTEM

Time Base

10 μs/div to 20 ms/div in 6 calibrated steps (1-5-20 sequence).

x10 MAG extends fastest sweep rate to 1 μs/div

Continuously variable between steps and to at least 0.1 s/div

Accuracy

±3 % (+10 to +35 °C)

Additional error for magnifier ±2 %

TRIGGERING SYSTEM

Trigger modes

Automatic (sweep free-runs in the absence of a trigger and for signals below 100 Hz) Normal (sweep runs when triggered).

Trigger source

CH1, CH2, External

Trigger slope

+ or -

Triggering level variable range — Internal ; ±6 div or more; External; approx. ±2 V

Triggering sensitivity and frequency

	Internal	External
50 Hz to 1 MHz	1 div deflection	400 mV
1 MHz to 5 MHz	2 div deflection	800 mV

Trigger coupling

AC

External trigger input impedance

Approx. 1 M ohm; Approx. 40 pF

Maximum input voltage

100 V (DC + peak AC), 100 Vp-p AC at 1 kHz or less.

X-Y OPERATION

CH1 ; Horiz, CH2 ; Vert

Deflection factor

Same as vertical deflection

Accuracy

Y: ±3 % (+10 to +35 °C)

X: ±5 % (+10 to +35 °C)

Additional error for magnifier ±2 %

X-bandwidth

DC to at least 100 kHz

Phase error

3 ° or less from DC to 10 kHz

CALIBRATOR

Sweep gate output, 2 V ± 10 % (+15 °C to +35 °C)

POWER SUPPLY

VOLTAGE (50/60 Hz)	FUSE
100 V (90 - 110 V)	1 A
120 V (108 - 132 V)	1 A
220 V (198 - 242 V)	0.5 A
240 V (216 - 264 V)	0.5 A

Nominal voltage ±5 % at 400 Hz

Power supply frequency : 50, 60, 400 Hz

Power consumption : Approximately 20 W

External DC source of 11.5 V to 14 V, requires approx. 0.9 A.

Operates from an AD-058G Battery Pack.

ENVIRONMENT

Limit of operation temperature	0 - 40 °C
Limit of operation humidity	35 - 85 %
Rated range of use temperature	10 - 35 °C
Rated range of use humidity	45 - 85 %
Storage and transportation temperature	-20 - 70 °C

DIMENSIONS AND WEIGHT

Height	80 mm	3.15"
Width	165 mm	6.5"
Depth	250 mm	9.8"
Depth (with handle extended)	360 mm	18.17"
Net	2.9 kg	6.4 lbs.

2. ACCESSORIES

This instrument is shipped along with following accessories.

— V-058G —

2 Probes (AT-10 AK 1.5)

1 AC power cord

1 Operation Manual

3. PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the oscilloscope. The severity of environment to which this instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is just prior to the recalibration of the instrument.

Disassembly

Remove all of the screws on the top cover of the instrument, then gently remove the top cover.

Take the same procedure for the bottom cover.

Most of the internal parts of the instrument are now accessible.

(See section 10. Exploded view)

Cleaning

The instrument should be cleaned as often as the operating conditions require, since the accumulation of dirt in the instrument may cause the component breakdown.

The covers can provide protection against dust in the interior of the instrument. Loose dust accumulated on these covers can be removed with a soft cloth or small brush.

Dirt that remains can be removed with a soft cloth applying in a mild detergent and water solution. Abrasive cleaners should not be used.

Cleaning the interior should be only occasionally necessary. The best way to clean the interior is to blow off the dust with a dry, low-velocity stream of air. A soft-bristle brush or a cotton-tipped applicator is useful for cleaning narrow spaces or for cleaning more delicate components.

4. CALIBRATION

Hitachi Denshi, Ltd. provides complete instrument repair and recalibration at our office, and authorized dealer. Contact your local Hitachi Denshi sales office or representative.

4.1 Calibration interval

To maintain instrument accuracy, perform the calibration of the V-058G at least every 1000 hours of operations or every six month if used infrequently.

4.2 Test equipment required

The following test equipment and accessories, or its equivalent, are required for the complete calibration of the V-058G. Specifications given for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications.

All the test equipment is assumed to be correctly calibrated and operated within the listed specification. Operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

4.3 Preliminary procedure

This instrument should be calibrated at an ambient temperature of +20 °C (±5 °C) for best overall accuracy.

1. Connect the instrument to AC line voltage, 50/60/400 Hz line source.
2. Set the instrument controls as given in the preliminary control settings. Allow at least fifteen minutes of warmup before proceeding.
3. See the adjustment locations in the pullout pages.

Table 4-2

TEST EQUIPMENT REQUIRED

Description	Minimum specification	Usage	Example of applicable test equipment
1. Constant amplitude signal generator	50kHz reference frequency; maximum frequency 70MHz; variable amplitude	Check horizontal, vertical and trigger bandwidth.	
2. Standard amplitude calibrator	Amplitude accuracy: 0.25%, variable amplitude; 5mV to 40V; frequency: 1 kHz square wave	Check horizontal and vertical gain.	
3. Square-wave generator	Variable frequency: 10Hz to 1MHz; output amplitude; 10mV to 100V	Check probe and vertical compensation.	
4. Digital voltmeter	0.1% accuracy	Check power supply.	
5. Time mark generator	0.1% accuracy	Check horizontal timing.	
6. Cable	Impedance, 50 ohms; type, RG-58/U; length, 42 inches, connectors, BNC	External trigger operation check. Horizontal gain check and adjustment.	Hitachi part No.4202
7. Termination	Impedance, 50 ohms; connectors, BNC	Vertical amplifier compensation checks and adjustment.	
8. Attenuator	Ratio, 1/10; connectors, BNC; impedance, 50 ohms	Vertical amplifier bandwidth check.	
9. T-connector	Connectors, BNC	External trigger operation checks.	Hitachi part No.1301

4.4 Preliminary control settings

Set the instrument controls as follows, when starting the calibration procedures.

Controls	Settings	Controls	Settings
FOCUS	Midrange		
TRACE ROTATION	As desired		
- VERT -			
V.POSITION	Midrange		
INPUT COUPLING	GND (AC-GND-DC)	- TRIG -	
VOLTS/DIV	0.1 V/DIV		
V.MODE	CH1	LEVEL	Midrange (pulle out)
		SLOPE	+
- HORZ -			
H.POSITION	Midrange		
PULL x10 MAG	Normal, Pushed in	SOURCE	CH1
TIME/DIV	1 ms		

4.5 Initial starting procedure

1. Rotate the INTENSity control to the maximum and set the POWER switch to ON.
2. Wait a few seconds for the cathode ray tube (CRT) to warm up. A trace should appear on the CRT.
3. Adjust the FOCUS control for the best focused display.
4. Readjust the POSITION controls if necessary, to center the trace.

POWER SUPPLY AND DISPLAY CALIBRATION

NOTE

Before you start operation, see the adjustment locations in the pullout pages.

Control settings

Preset the controls as given in the preliminary control setting

1. Adjust +10 Volt Power Supply
   a. Connect the DC voltmeter between test point of 0 V and +10 V.
   b. CHECK - Meter reading: +10 volts, ±0.05 volt.
   c. ADJUST - +10 volts adjustment, RV1112 for ±10.0 volts, ±0.03 volt.
   d. Connect the DC voltmeter between the test point 0 V and chassis ground.
   e. CHECK - Meter reading; 0 ± 0.05 volt.
2. Adjust +12 Volt Power Supply
   a. Connect the DC voltmeter between the test point +12 V chassis ground.
   b. CHECK - Meter reading; +12 volts, ±0.05 volt.
   c. ADJUST - +12 volts adjustment, RV1130 for +12.00 volts, ±0.03 volt.
3. Adjust -12 Volt Power Supply
   a. Connect the DC voltmeter between the test point -12 V chassis ground.
   b. CHECK - Meter reading -12 volts, ±0.05 volt
   c. ADJUST - -12 volts adjustment, RV1131 for -12.00 volts, ±0.03 volt.
4. Adjust Trace Rotation
   a. Position the trace to the center horizontal line with the vertical POSITION control.
   b. CHECK - That the trace is parallel with the center horizontal line.
   c. ADJUST - TRACE ROTATION adjustment, RV1050, so the trace is parallel to the center horizontal line.
5. Adjust Astigmatism
   a. Set the H.DISP switch to the X-Y position, and the input coupling switch to GND.

b. Set the INTENsity control for a small spot, as the following figure, using the position controls.

c. Check that the spot is round.

d. Adjust the FOCUS adjustment and ASTIG adjustment RV1030 for a round spot.

VERTICAL SYSTEM CALIBRATION

Note 2

Vertical Controls

V/DIV	
Vertical POSITION	Midrange
x5 VERT GAIN	Pushed in
INPUT (side panel)	GND

Trigger Controls

LEVEL	Midrange (Pulled out)
SOURCE (side panel)	CH1 or CH2
SLOPE (side panel)	+

Power Controls

POWER (front cover)	ON
POWER MODE (rear panel)	AC

Horizontal Controls

TIME(ms)/DIV	1
Horizontal POSITION	Midrange
x10 HORIZ MAG	Pushed in
VARIABLE (top cover)	CAL

Horizontal Display Controls

H.DISP (side panel)	SWP

CRT Controls

FOCUS (top cover)	Midrange
INTEN (top cover)	Midrange

6. Adjust Volts/Division Balance (STEP ATT BAL)
   a. Position the trace to the center horizontal line with the vertical POSITION control.
   b. CHECK - Change the V/DIV switch from 0.2 volt to 0.5 volt. Trace should not move more than 0.1 division.
   c. Adjust RV35(CH1), RV135(CH2) for minimum trace shift when rotation the V/DIV switch from 0.2 volt to 0.5 volt. If necessary, rotate the vertical position control to keep the trace in the center of the screen.
7. Adjust Vertical x5 Balance.
   a. Position the trace to the center horizontal line with the vertical POSITION control.
   b. Pull the x5 VERT GAIN switch out. (Do not rotate)
   c. CHECK - Trace shift should be less than 0.5 division vertically.
   d. ADJUST - x5 BAL adjustment, RV51, to return the trace to the center horizontal line.
   e. Recheck step 6. If readjustment is necessary, recheck this step also.
8. Adjust Vertical x1 Gain
   a. Change the following control settings:
      INPUT; DC
   b. Connect the standard amplitude calibrator output connector to the V-IN connector with a 50-ohm BNC cable.
   c. Set the standard amplitude calibrator for a 0.2 volt square-wave output.
   d. Center the display about the center horizontal line with the vertical POSITION control.
   e. CHECK - CRT display for four divisions of deflection.
   f. ADJUST - VERT x1 GAIN adjustment, RV55(CH1), RV155(CH2), for exactly four divisions of deflection.
9. Adjust Vertical x5 Gain
   a. Set the standard amplitude calibrator for a 50 milli-volt square-wave output.
   b. Pull the x5 VERT GAIN switch out.

c. Center the display about the center horizontal line with the vertical POSITION control.

d. CHECK - CRT display for five divisions of deflection.

e. ADJUST - VERT x5 GAIN adjustment, R54, for exactly five divisions of deflection.

10. Adjust Input Capacitance

a. Change the following control settings:

V/DIV 0.05

b. Connect the capacity meter to the input.

c. CHECK - Set the Input Capacitance within 40 pF $\pm$4 pF.

d. ADJUST - Adjust CV11 to set the Capacitance of input within 40 pF $\pm$4 pF.

11. Adjust Volts/Division Compensation

a. Change the following control settings.

V/DIV 0.5

b. Connect the square-wave generator output connector to the input connector with a BNC cable.

c. Set the square-wave generator for a five-division display at one kilohertz.

d. Center the display about the center horizontal line with the vertical POSITION control.

e. CHECK - CRT display must be similar to Fig. 1(B).

f. ADJUST - Adjust the CV13, CV113 to make the CRT display similar to Fig. 1 (B).

g. Change the following control settings;

V/DIV 0.05

h. Connect the AT-10AK1.5 type Probe to the VERT INPUT.

i. Connect the probe tip to square-wave generator output connector.

j. Set the square-wave generator for a five-division display at one kilohertz.

k. Adjust the trimmer capacitor in the Probe to obtain the CRT display similar to Fig. 1 (B).

l. Change the following control settings;

V/DIV 0.5

m. Set the square-wave generator for a five-division display at one kilohertz.

n. CRT display must be similar to Fig. 1 (B).

o. ADJUST - Adjust CV12, CV112 to obtain the CRT display similar to Fig. 1 (B).

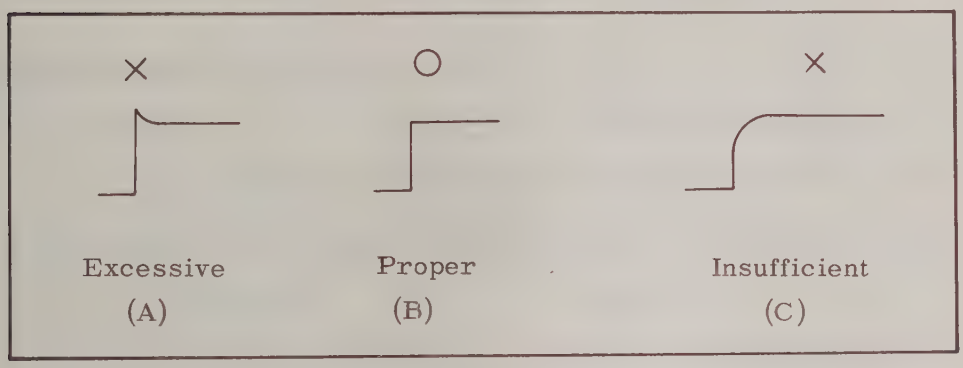


Fig. 1

12. Check High-Frequency Compensation

a. Change the following control settings;

x5 VERT GAIN	Pushed in
TIME/DIV (ms)	0.01
x10 HORIZ MAG	Pulled out

b. Square-wave generator fast-rise + output

Connect the square-wave generator fast-rise + Output connector to the INPUT connector through a 50-ohm BNC cable, a x 10 attenuator and a 50-ohm BNC termination.

c. Set the square-wave generator for a four-division display at 100 kilohertz.

d. Move the leading edge of the square-wave onto the viewing area with the horizontal POSITION control.

e. CHECK - The total aberrations of square-wave response of CRT display must not exceed 5 % peak to peak.

13. X-Y operation

13-1 Adjust X gain

a. Change the following control settings;

H DISP	X-Y
CH1 INPUT	AC
CH2 INPUT	GND
V MODE	CH2
X VAR (RV470)	Clockwise

b. Set the VOLTS/DIV switch to the 0.1 V position.

c. Connect the standard amplitude calibrator to the CH1 INPUT or X INPUT connector.

d. Set the standard amplitude calibrator for 0.5 V.

e. Check for a display of five divisions.

f. ADJUST - The X GAIN adjustment RV474 for a display of five divisions within 6 %.

13-2 Adjust X center

a. Change the following control settings;

H DISP	X-Y
CH1 INPUT	GND
H POSITION	midposition

b. Check to see that the round spot is near the center graticule and is within $\pm$ 0.2 division against horizontal line.

c. ADJUST - The X CENT adjustment RV473 to the position spot at the center.

TRIGGER SYSTEM CALIBRATION

Vertical Controls		Horizontal Controls	
V/DIV	0.1	TIME(ms)/DIV	1
Vertical POSITION	Midrange	Horizontal POSITION	Midrange
x5 VERT GAIN	Pushed in	x10 HORIZ MAG	Pushed in
INPUT (side panel)	DC	VARIABLE (TOP COVER)	CAL

Triggering Controls

Horizontal Display Controls

LEVEL	Midrange (pulled out)	H.DISP (side panel)	SWP
SOURCE (side panel)	CH1 or CH2 CH2	CRT Controls	
SLOPE (side panel)	+	FOCUS (TOP cover)	Midrange
		INTEN.(TOP cover)	Midrange

Power Controls

POWER (front cover)	ON
POWER MODE (rear panel)	AC

14. Adjust Trigger Sensitivity

    a. Connect the Medium - Frequency constant-amplitude sine wave generator to the INPUT connector through a 50-ohm BNC cable, a x10 BNC attenuator and a 50-ohm BNC termination.

    b. Set the constant-amplitude generator for a 0.6 division display at one kilohertz.

    c. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

    d. Turn the LEVEL control to full clockwise.

    e. CHECK - The waveform is not observed on the CRT display.

    f. Turn the LEVEL control to full counterclockwise.

    g. CHECK - The waveform is not observed on the CRT display.

    h. ADJUST - Set INPUT switch to GND. Rotate RV517 clockwise to find the point at which the trace just appears.
    Then, rotate RV517 clockwise to find the point at which the trace just disappears. Set RV517 in the center of the above points.

15. Adjust Trigger Slope and Level Centering

    a. Change the following control settings;

INPUT (side panel)	DC
SOURCE (side panel)	CH1 or CH2
LEVEL	Midrange (Pushed in)

    b. Set the constant-amplitude generator for a 0.6 division display at one kilohertz.

    c. CHECK - Stable display should be obtained in both the + and -

SLOPE without adjusting LEVEL control.

d. ADJUST - Adjust RV410 for stable display in both the + and - SLOPE without adjusting LEVEL control.

16. Check External Triggering Operation

a. Change the following control settings;

SOURCE (side panel)	EXT
SLOPE (side panel)	+
LEVEL	Midrange (Pushed in)

b. Connect the constant-amplitude sine wave generator to the INPUT connector through the 50-ohm BNC cable, 50-ohm BNC termination and the BNC T connector. Connect the output of the BNC T connector to the EXT TRIG INPUT connector with a 50-ohm BNC cable.

c. Set the constant-amplitude generator for a 3 division display (0.3 volts) at 100 hertz.

d. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

e. Set the constant-amplitude generator for a 3 division display (0.3 volts) at one megahertz.

f. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

g. Change the following Control settings;

V/DIV	0.2
x10 HORIZ MAG	Pulled in
TIME(ms)/DIV	0.05

h. Set the constant-amplitude generator for a 3 division display (0.6 volts), then change the frequency to five megahertz without changing the amplitude setting.

i. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

j. Change the following control settings;

V/DIV	0.1
LEVEL	Midrange (pulled out)
x10 HORIZ MAG	Pushed in

TIME(ms)/DIV 1

k. Set the constant-amplitude generator for a 3 division display (0.3 volts) at 100 hertz.

l. CHECK - Stable CRT display is presented.

m. Set the constant-amplitude generator for a 3 division display (0.3 volts) at one kilohertz.

n. CHECK - Stable CRT display is presented.

o. Change the following Control settings;

V/DIV 0.2

p. Set the constant-amplitude generator for a 3 division display (0.6 volts), then change the frequency to five megahertz without changing the amplitude setting.

q. CHECK - Stable CRT display is presented.

17. Check Internal Triggering Operation

a. Change the following Control settings;

V/DIV	0.1
SLOPE (side panel)	CH1 or CH2
SLOPE (side panel)	+
LEVEL	Midrange (Pushed in)

b. Connect the constant-amplitude sine wave generator to the INPUT connector through a 50-ohm BNC cable, a 50-ohm BNC termination.

c. Set the constant-amplitude generator for a 0.8 division display at 100 hertz.

d. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

e. Set the constant-amplitude generator for a 0.8 division display at one megahertz.

f. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

g. Set the constant-amplitude generator for a 1.7 division display at five megahertz.

h. CHECK - That a stable display can just be obtained by rotating the LEVEL control.

i. Change the following Control settings;

x10 HORIZ MAG	Pushed in
TIME (ms)/DIV	1
LEVEL	Midrange (pulled out)

j. Set the constant-amplitude generator for a 0.8 division display at 100 hertz.

k. Stable CRT display is presented.

l. Set the constant-amplitude generator for a 0.8 division display at one megahertz.

m. CHECK - Stable CRT display is presented.

n. Change the following Control settings;

x10 HORIZ MAG	Pulled out
TIME (ms)/DIV	0.05

o. Set the constant-amplitude generator for a 1.7 division display at five megahertz.

p. CHECK - Stable CRT display is presented.

HORIZONTAL SYSTEM CALIBRATION

Vertical Controls

V/DIV	1.0
Vertical POSITION	Midrange
x5 VERT GAIN	Pushed in
INPUT (side panel)	DC

Horizontal Controls

TIME(ms)/DIV	1.0
Horizontal POSITION	Midrange
x10 HORIZ MAG	Pulled out
VARIABLE (top cover)	CAL

Trigger Controls

LEVEL	Midrange (pulled in)
SOURCE (side panel)	CH1 or CH2
SLOPE (side panel)	+

Horizontal Display Controls

H.DISP (side panel)	SWP

CRT Controls

FOCUS (top cover)	Midrange
INTEN (top cover)	Midrange

Power Controls

POWER (front cover)	ON
POWER MODE (rear panel)	AC

18. Adjust Magnified Timing

a. Connect the time-mark generator to the INPUT connector through a 50-ohm BNC cable, a 50-ohm BNC termination.

b. Set the time-mark generator for 0.1 millisecond markers.

c. CHECK - CRT display one maker each division between the left- and right-vertical lines of the graticule (See Fig. 2). Eleventh marker must be with 0.5 division (within ±5 %) of the right vertical line with the first marker positioned exactly to the left vertical line.

d. ADJUST - x10 Gain, RV802, for one marker each division. The first and eleventh markers must coincide exactly with their respective graticule lines (reposition the display slightly with the horizontal POSITION control if necessary).

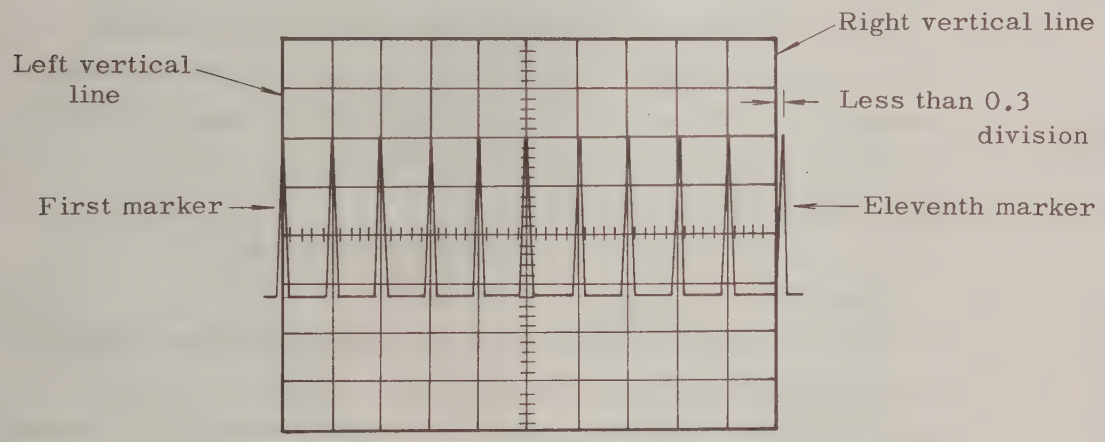


Fig. 2

19. Adjust Normal Timing

a. Change the following Control settings;

x10 HORIZ MAG Pushed in

b. Set the time-mark generator for one-millisecond markers.

c. CHECK - CRT display one marker each division between the left- and right-vertical lines of the graticule. (See Fig. 2). Eleventh marker must be within 0.3 division (within ±3 %) of the

right vertical line with the first marker positioned exactly to the left vertical line.

d. ADJUST - x1 Gain, RV803, for one marker each division. The first and eleventh markers must coincide exactly with their respective graticule lines (reposition the display slightly with the horizontal POSITION control if necessary).

20. Adjust low speed sweep accuracy.

a. Set the time-mark generator for 20 ms time marks.

b. Set the TIME/DIV switch to 20 ms.

c. CHECK-CRT display one marker each division between the left- and right-vertical line of the graticule. (See Fig. 2). Eleventh marker must be within 0.3 division (within ±3 %) of the right vertical line with the first marker positioned exactly to the left vertical line.

d. ADJUST-20 ms Gain, RV540, for one marker each division. The first and eleventh markers must coincide exactly with their respective graticule line (reposition the display slightly with the horizontal POSITION control if necessary).

21. ADjust High speed sweep accuracy.

a. Set the time-mark generator for 50 ms time marks.

b. Set the TIME/DIV switch to 0.05 ms.

c. CHECK-CRT display one marker each division between the left- and right-vertical line of the graticule. (See Fig. 2). Eleventh marker must be within 0.3 division (within ±3 %) of the right vertical line with the first marker positioned exactly to the left vertical line.

d. ADJUST - 50 ms Gain, RV541, for one marker each division. The first and eleventh markers must coincide exactly with their respective graticule line (reposition the display slightly with the horizontal POSITION control if necessary).

OTHER CALIBRATION

22. Adjust Batteries Protect

a. Change the following Control settings;
POWER MODE (rear panel) EXT DC

b. Connect DC Voltmeter to the external power supply as indicated in Fig. 3.

c. Connect the external power supply for 10.0 Volts ±0.1 Volt.

d. CHECK - Power lamp (front panel) indicates red clearly.

e. ADJUST - Control the external power supply for 10.3 Volts ± 0.1 Volt. Adjust RV1106 (BAT) to the point where the power lamp indication changes from green to red.

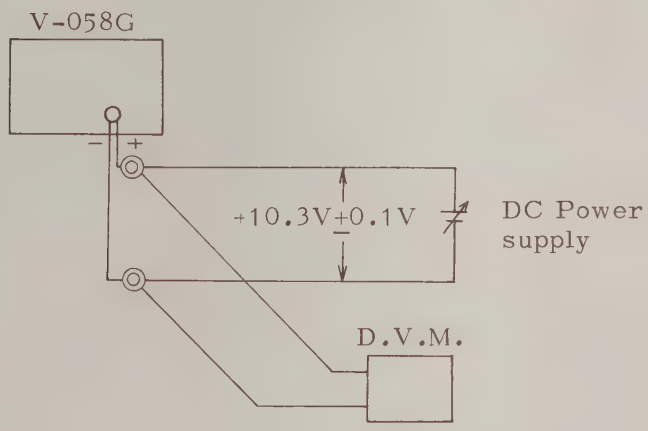
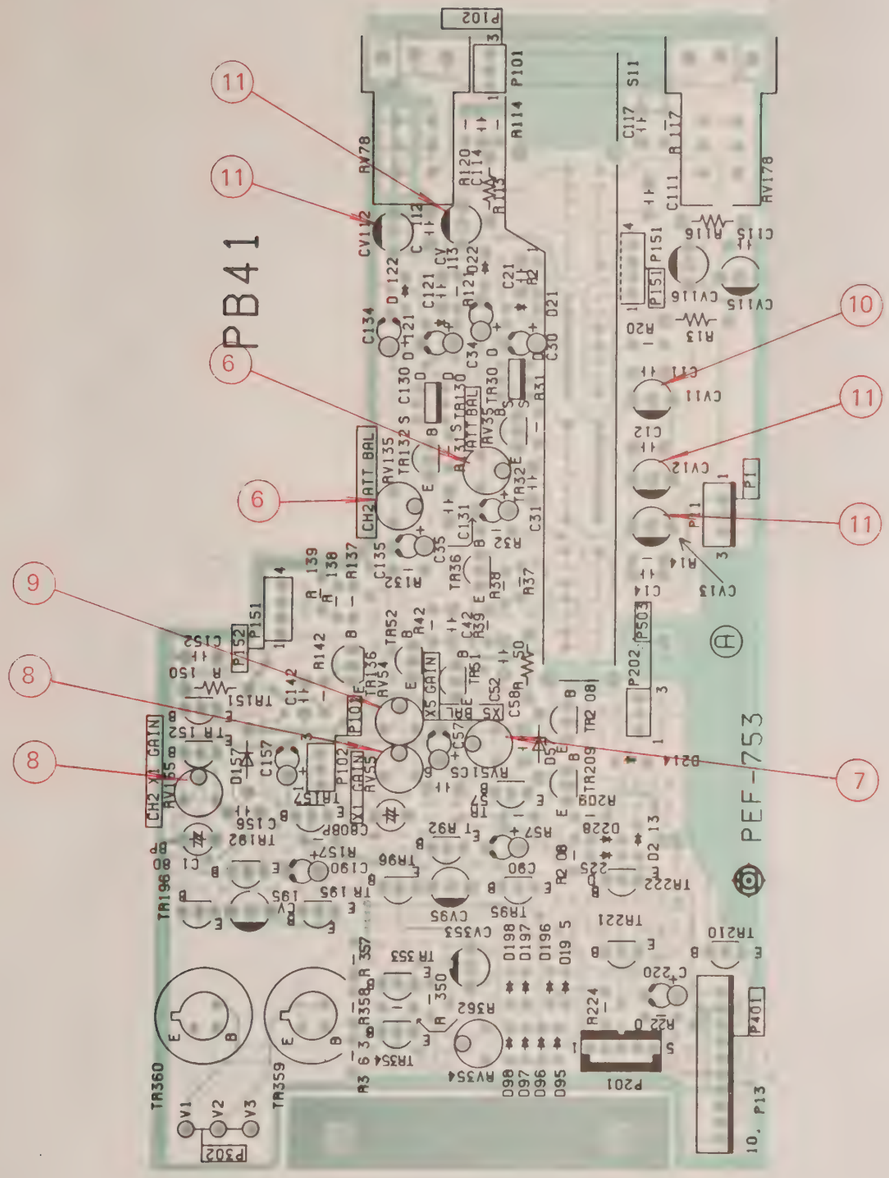
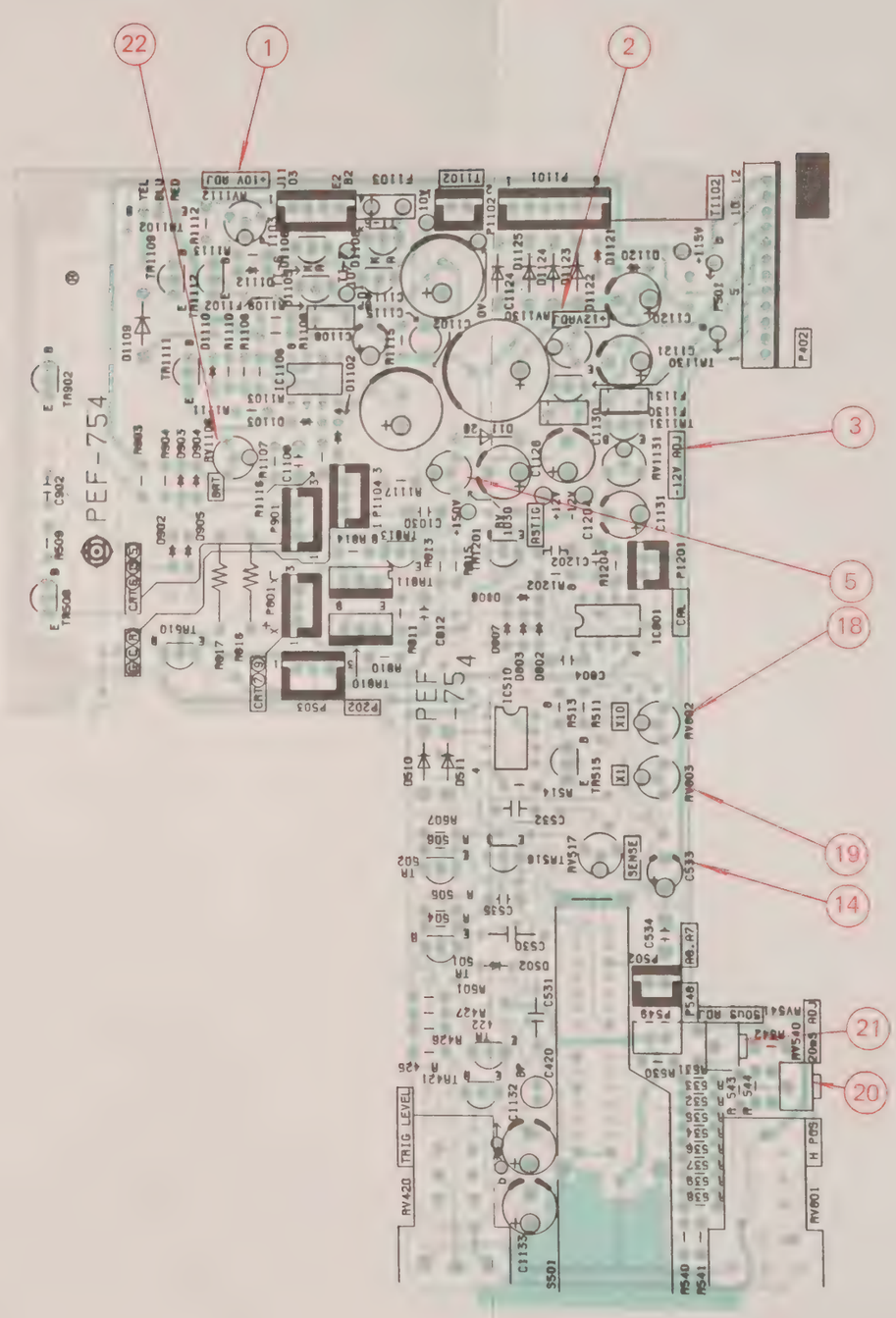


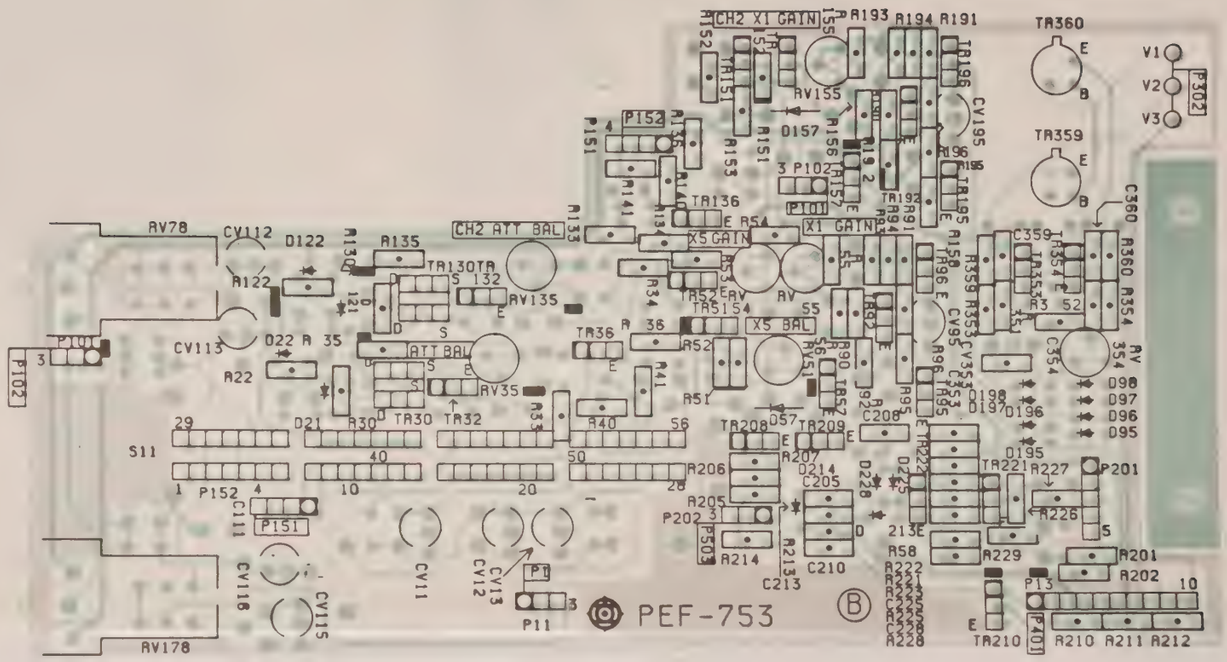
Fig. 3

5. ELECTRICAL PARTS ARRANGEMENT (WITH ADJUSTMENT LOCATIONS)

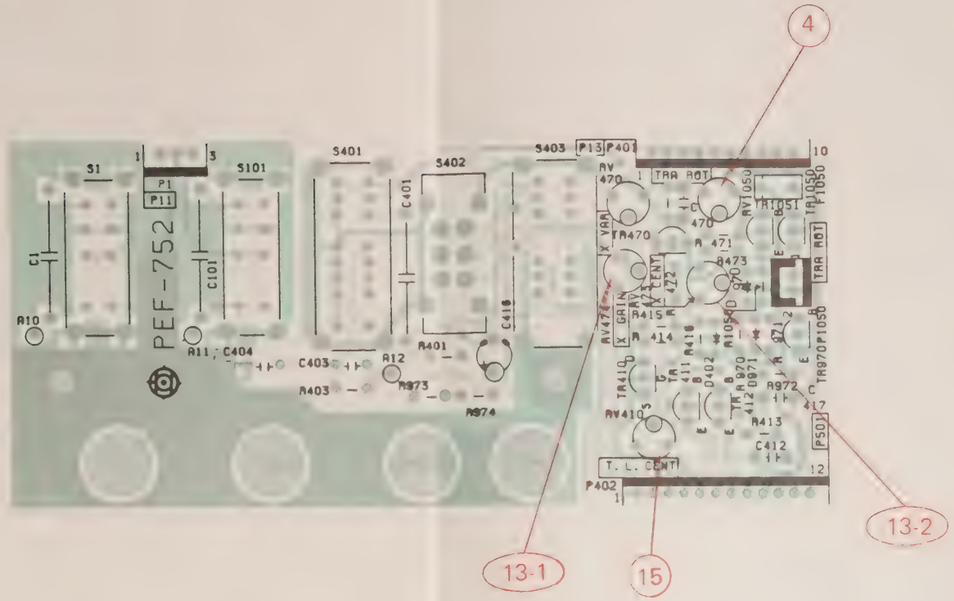


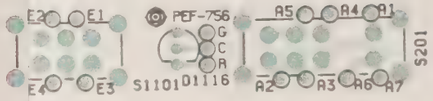


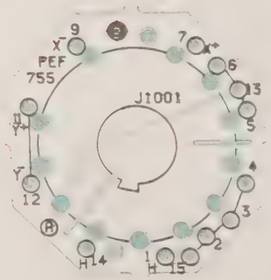
PEF754,753 (Parts side)

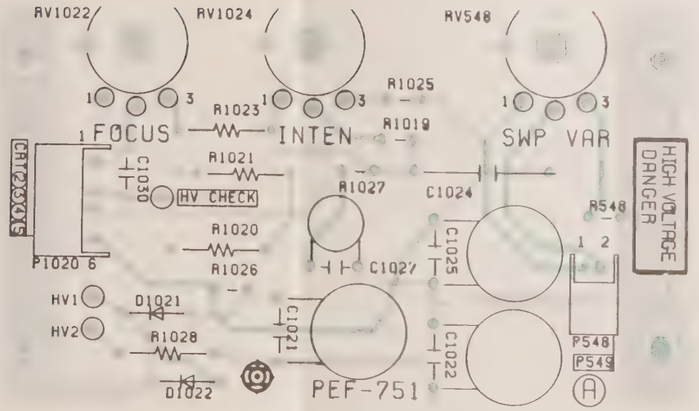

PEF-753
CH2 X1 GAIN
CH2 ATT BAL
X5 GAIN
X1 GAIN
X5 BAL
ATT BAL
TRIG LEVEL
SENSE
+10V ADJ
+12V ADJ
-12V ADJ
+115V
ASTIG
CAL
X10
X1
50Ω ADJ
20MΩ ADJ
BAT

PEF-754
+10V ADJ
+12V ADJ
-12V ADJ
ASTIG
CAL
SENSE
TRIG LEVEL
50Ω ADJ
20MΩ ADJ
BAT

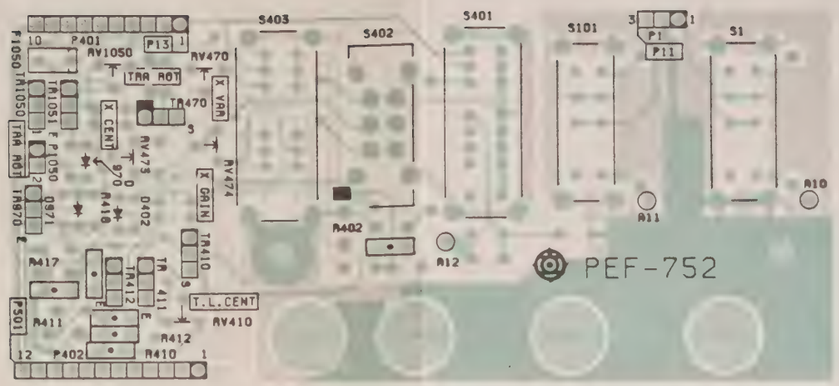






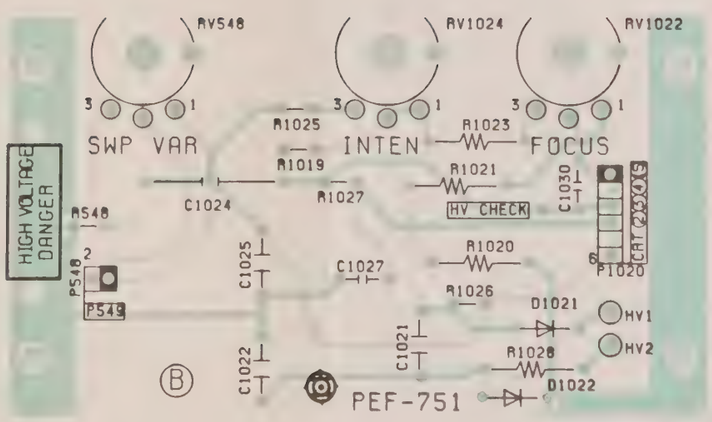


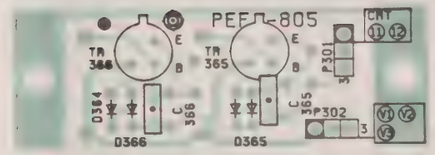
PEF757,805,755.752,751 (Parts side)

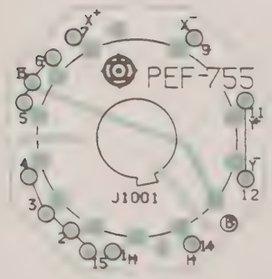

S403
S402
S401
S101
S1
P1
P11
P401
P13
AV1050
AV470
TRA ROT
X YAR
TR470
X CENT
AV473
AV474
X GAIN
TR410
T.L.CENT
AV410
TR 411
TR412
P1050
TR1051
TR970
D971
D970
D402
R418
R417
R411
R412
R410
P501
P402
R402
R12
R11
R10
PEF-752

B3
B1
S1102
PEF-757
B4
B2

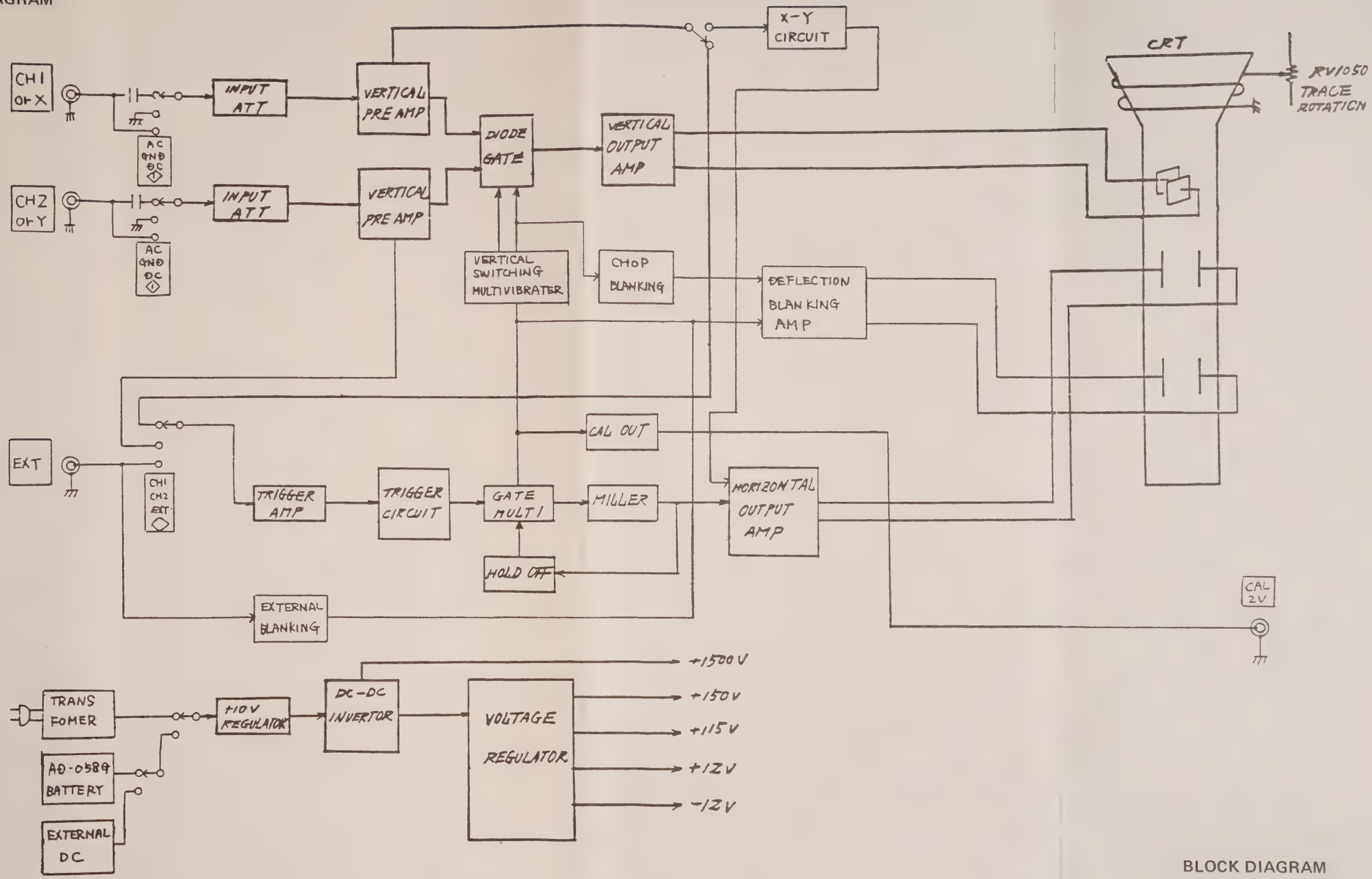
A1
A4
A5
PEF-756
G
C
A
D1116
S1101
E1
E2
A6
A7
A3
A2
E3
E4
S201


RV548
RV1024
RV1022
SWP VAR
INTEN
FOCUS
R1025
R1023
R1019
R1021
R1027
C1024
C1030
HV CHECK
HIGH VOLTAGE
DANGER
RS48
PS48
PS49
C1025
C1027
R1020
R1026
D1021
HV1
HV2
C1021
C1022
R1028
D1022
P1020
PEF-751


PEF-805
TR
366
TR
365
P301
CNT
P302
D366
D365


PEF-755
J1001

6. BLOCK DIAGRAM



BLOCK DIAGRAM

7. ELECTRICAL PARTS LIST

① INPUT AMP

Symbol	Part Code	Description	A
C 1	CQX0068	C, Plastic 400V 0.047μF ±10%	1
C 101	CQX0068	C, Plastic 400V 0.047μF ±10%	1
C 401	CQX0068	C, Plastic 400V 0.047μF ±10%	1
C 403	CMF0052	C, Mica FM07ZC680J5	1
C 404	CCD0282	C, Ceramic 500V 47 pF ±5%	1
C 412	CQA0119	C, Plastic 50V 2200 pF ±10%	1
C 416	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 417	CQA0122	C, Plastic 50V 47000 pF ±10%	1
C 470	CCC1030	C, Ceramic 50V 10000 pF Z	1
D 402	HDS0437	Diode 1SS133	1
D 970	HDS0477	Diode 1SS110	1
D 971	HDS0477	Diode 1SS110	1
F 1050	EFZ0013	IC Protect ICP-F10 (0.4A)	1
P 1	JBX2112	Connector 164711-3	1
P 401	JBX2090	Connector 1-164711-0	1
P 402	JBX2092	Connector 1-16471	1
P 1050	JBB0027	Connector B2B-XH-A	1
R 401	RCE0800	R, Carbon 1/4W 470kΩ ±5%	1
R 402	RME0864	R, Metal Chip 1/8W 100Ω ±5%	1
R 403	RCE0800	R, Carbon 1/4W 470kΩ ±5%	1
R 410	RME0890	R, Metal Chip 1/8W 15kΩ ±5%	1
R 411	RME0862	R, Metal Chip 1/8W 68Ω ±5%	1
R 412	RME0858	R, Metal Chip 1/8W 33Ω ±5%	1
R 413	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R 414	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 415	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 416	RCE0764	R, Carbon 1/4W 390Ω ±5%	1
R 417	RME0876	R, Metal Chip 1/8W 1.0kΩ ±5%	1
R 418	RME0886	R, Metal Chip 1/8W 6.8kΩ ±5%	1
R 470	RCE0800	R, Carbon 1/4W 470kΩ ±5%	1
R 471	RCE0780	R, Carbon 1/4W 8.2kΩ ±5%	1
R 472	RCE0768	R, Carbon 1/4W 820Ω ±5%	1
R 473	RCE0783	R, Carbon 1/4W 15kΩ ±5%	1
R 970	RCE0797	R, Carbon 1/4W 220kΩ ±5%	1
R 971	RCE0779	R, Carbon 1/4W 6.8kΩ ±5%	1
R 972	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R 973	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 974	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1050	RCE0749	R, Carbon 1/4W 22Ω ±5%	1
RV 410	RNE0052	VR, Metal EVN 39C00YB23(2K)	1
RV 470	RNE0054	VR, Metal EVN 39C00YB15(100K)	1
RV 473	RNE0047	VR, Metal EVN 39C00YB54(50K)	1
RV 474	RNE0051	VR, Metal EVN 39C00YB14(10K)	1
RV 1050	RNE0070	VR, Metal EVN 39C00YB53(5K)	1
S 1	SSV0056	SW, Slide SSB023(2) L=6 NS PCB	1
S 101	SSV0056	SW, Slide SSB023(2) L=6 NS PCB	1
S 401	SSV0031	SW, Slide SSB022 L=6 NS Wire	1
S 402	SSV0041	SW, Slide SSB022 L=6NON Short	1
S 403	SSV0031	SW, Slide SSB022 L=6 NS WIRE	1
TR 410	HTK0081	Transistor 2SK304E	1
TR 411	HTC0148	Transistor 2SC458-C-	1
TR 412	HTC0148	Transistor 2SC458-C-	1
TR 470	HTK0081	Transistor 2SK304E	1
TR 970	HTC0148	Transistor 2SC458-C-	1
TR 1050	HTC0148	Transistor 2SC458-C-	1
TR 1051	HTA0224	Transistor 2SA1029 D	1

② VERTICAL

Symbol	Part Code	Description	A
C 12	CCD0275	C, Ceramic 500V 5 pF ±0.25pF	1
C 14	CCD0281	C, Ceramic 500V 33 pF ±5%	1
C 21	CCD0287	C, Ceramic 500V 4700 pF +100 -0%	1
C 30	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 31	CQA0125	C, Plastic 50V 4700 pF ±10%	1
C 34	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 35	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 42	CQA0119	C, Plastic 50V 2200 pF ±10%	1
C 52	CQA0119	C, Plastic 50V 2200 pF ±10%	1
C 56	CCC1007	C, Ceramic 50V 22 pF ±5%	1
C 57	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 58	CEX0230	C, Plastic 50V 10000 pF ±10%	1
C 80	CEX0230	C, AL Elyc 50V 1μF BP	1
C 90	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 111	CCD0273	C, Ceramic 500V 2 pF ±0.25pF	1
C 112	CCD0273	C, Ceramic 500V 2 pF ±0.25pF	1
C 114	CCD0281	C, Ceramic 500V 33 pF ±5%	1
C 115	CCD0277	C, Ceramic 500V 10 pF ±0.5pF	1
C 117	CCD0281	C, Ceramic 500V 33 pF ±5%	1
C 121	CCD0287	C, Ceramic 500V 4700 pF +100 -0%	1
C 130	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 131	CQA0125	C, Plastic 50V 4700 pF ±10%	1
C 134	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 135	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 142	CQA0119	C, Plastic 50V 2200 pF ±10%	1
C 152	CQA0119	C, Plastic 50V 2200 pF ±10%	1
C 156	CCC1003	C, Ceramic 50V 12 pF ±5%	1
C 157	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 180	CEX0230	C, AL Elyc 50V 1μF BP	1
C 190	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 205	CCG0139	C, Cer. Chip 50V 47 pF ±5%	1
C 208	CCG0201	C, Cer. Chip 50V 470 pF ±5%	1
C 210	CCG0142	C, Cer. Chip 50V 82 pF ±5%	1
C 213	CCG0201	C, Cer. Chip 50V 470 pF ±5%	1
C 220	CES0131	C, AL Elyc 16V 10μF ±20%	1
C 225	CCG0201	C, Cer. Chip 50V 470 pF ±5%	1
C 228	CCG0201	C, Cer. Chip 50V 470 pF ±5%	1
C 353	CCG0132	C, Cer. Chip 50V 22 pF ±5%	1
C 359	CCG0139	C, Cer. Chip 50V 47 pF ±5%	1
C 360	CCG0139	C, Cer. Chip 50V 47 pF ±5%	1
C 365	CCG0205	C, Cer. Chip 50V 1000 pF ±10%	1
C 366	CCG0205	C, Cer. Chip 50V 1000 pF ±10%	1
CV 11	CVE0068	C, Variable ECR-HC010A11	1
CV 12	CVE0068	C, Variable ECR-HC010A11	1
CV 13	CVE0068	C, Variable ECR-HC010A11	1
CV 95	CVE0057	C, Variable ECR-HC020D11	1
CV 112	CVE0068	C, Variable ECR-HC010A11	1
CV 113	CVE0068	C, Variable ECR-HC010A11	1
CV 115	CVE0068	C, Variable ECR-HC010A11	1
CV 116	CVE0068	C, Variable ECR-HC010A11	1
CV 195	CVE0068	C, Variable ECR-HC010A11	1
CV 353	CVE0068	C, Variable ECR-HC010A11	1
D 21	HDS0477	Diode 1SS110	1
D 22	HDS0477	Diode 1SS110	1
D 57	HDH0040	Diode Zenner HZ7(B)	1
D 95	HDS0437	Diode 1SS133	1
D 96	HDS0437	Diode 1SS133	1
D 97	HDS0437	Diode 1SS133	1
D 98	HDS0437	Diode 1SS133	1
D 121	HDS0477	Diode 1SS110	1

Symbol	Part Code	Description				A
D 122	HDS0477	Diode	1SS110			1
D 157	HDH0040	Diode	Zenner HZ7(B)			1
D 195	HDS0437	Diode	1SS133			1
D 196	HDS0437	Diode	1SS133			1
D 197	HDS0437	Diode	1SS133			1
D 198	HDS0437	Diode	1SS133			1
D 213	HDS0437	Diode	1SS133			1
D 214	HDS0437	Diode	1SS133			1
D 225	HDS0437	Diode	1SS133			1
D 228	HDS0437	Diode	1SS133			1
D 361	HDS0437	Diode	1SS133			1
D 364	HDS0437	Diode	1SS133			1
D 365	HDS0437	Diode	1SS133			1
D 366	HDS0437	Diode	1SS133			1
P 11	JBX2113	Connector	164713-3			1
P 13	JBX2091	Connector	1-164713-0(8440219)			1
P 201	JBB0060	Connector	B5B-XH-A			1
P 301	JBB0021	Connector	B3B-XH-A			1
P 302	JBB0021	Connector	B3B-XH-A			1
R 13	RMS0043	R, Metal	1/4W	900kΩ	±0.5%	1
R 14	RME1163	R, Metal	1/4W	111kΩ	±0.5%	1
R 20	RCE0802	R, Carbon	1/4W	1.0MΩ	±5%	1
R 21	RCE0800	R, Carbon	1/4W	470kΩ	±5%	1
R 22	RME0868	R, Met. Chip	1/8W	220Ω	±5%	1
R 30	RME0868	R, Met. Chip	1/8W	220Ω	±5%	1
R 31	RME1068	R, Metal	1/4W	475Ω	±1%	1
R 32	RME1068	R, Metal	1/4W	475Ω	±1%	1
R 33	RME0898	R, Met. Chip	1/8W	68kΩ	±5%	1
R 34	RME0856	R, Met. Chip	1/8W	22Ω	±5%	1
R 35	RME0898	R, Met. Chip	1/8W	68kΩ	±5%	1
R 36	RME0881	R, Met. Chip	1/8W	2.7kΩ	±5%	1
R 37	RME1154	R, Metal	1/4W	600Ω	±0.5%	1
R 38	RME1112	R, Metal	1/4W	301Ω	±1%	1
R 39	RME1112	R, Metal	1/4W	301Ω	±1%	1
R 40	RME0869	R, Met. Chip	1/8W	270Ω	±5%	1
R 41	RME0862	R, Met. Chip	1/8W	68Ω	±5%	1
R 42	RCE0770	R, Carbon	1/4W	1.2kΩ	±5%	1
R 50	RMS0016	R, Metal	1/4W	1.5MΩ	±1%	1
R 51	RME0880	R, Met. Chip	1/8W	2.2kΩ	±5%	1
R 52	RME0858	R, Met. Chip	1/8W	33Ω	±5%	1
R 53	RME0882	R, Met. Chip	1/8W	3.3kΩ	±5%	1
R 54	RME0859	R, Met. Chip	1/8W	39Ω	±5%	1
R 55	RME0866	R, Met. Chip	1/8W	150Ω	±5%	
R 56	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 57	RCE0772	R, Carbon	1/4W	1.8kΩ	±5%	1
R 58	RME0870	R, Met. Chip	1/8W	330Ω	±5%	1
R 90	RME0884	R, Met. Chip	1/8W	4.7kΩ	±5%	1
R 91	RME0884	R, Met. Chip	1/8W	4.7kΩ	±5%	1
R 92	RME0879	R, Met. Chip	1/8W	1.8kΩ	±5%	1
R 93	RME0883	R, Met. Chip	1/8W	3.9kΩ	±5%	1
R 94	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 95	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 96	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 113	RMS0043	R, Metal	1/4W	900kΩ	±0.5%	1
R 114	RME1163	R, Metal	1/4W	111kΩ	±0.5%	1
R 116	RMS0043	R, Metal	1/4W	900kΩ	±0.5%	1
R 117	RME1163	R, Metal	1/4W	111kΩ	±0.5%	1
R 120	RCE0802	R, Carbon	1/4W	1.0MΩ	±5%	1
R 121	RCE0800	R, Carbon	1/4W	470kΩ	±5%	1
R 122	RME0860	R, Met. Chip	1/8W	220Ω	±5%	1
R 130	RME0868	R, Met. Chip	1/8W	220Ω	±5%	1

Symbol	Part Code	Description				A
R 131	RME1068	R, Metal	1/4W	475Ω	±1%	1
R 132	RME1068	R, Metal	1/4W	475Ω	±1%	1
R 133	RME0898	R, Met. Chip	1/8W	68kΩ	±5%	1
R 134	RME0856	R, Met. Chip	1/8W	22Ω	±5%	1
R 135	RME0898	R, Met. Chip	1/8W	68kΩ	±5%	1
R 136	RME0881	R, Met. Chip	1/8W	2.7kΩ	±5%	1
R 137	RME1154	R, Metal	1/4W	600Ω	±0.5%	1
R 138	RME1154	R, Metal	1/4W	301Ω	±1%	1
R 139	RME1112	R, Metal	1/4W	301Ω	±1%	1
R 140	RME0869	R, Met. Chip	1/8W	270Ω	±5%	1
R 141	RME0862	R, Met. Chip	1/8W	68Ω	±5%	1
R 142	RCE0770	R, Carbon	1/4W	1.2kΩ	±5%	1
R 150	RMS0016	R, Metal	1/4W	1.5MΩ	±1%	1
R 151	RME0882	R, Met. Chip	1/8W	3.3kΩ	±5%	1
R 152	RME0858	R, Met. Chip	1/8W	33Ω	±5%	1
R 153	RME0882	R, Met. Chip	1/8W	3.3kΩ	±5%	1
R 155	RME0866	R, Met. Chip	1/8W	150Ω	±5%	1
R 156	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 157	RCE0772	R, Carbon	1/4W	1.8kΩ	±5%	1
R 158	RME0870	R, Met. Chip	1/8W	330Ω	±5%	1
R 190	RME0884	R, Met. Chip	1/8W	4.7kΩ	±5%	1
R 191	RME0884	R, Met. Chip	1/8W	4.7kΩ	±5%	1
R 192	RME0879	R, Met. Chip	1/8W	1.8kΩ	±5%	1
R 193	RME0883	R, Met. Chip	1/8W	3.9kΩ	±5%	1
R 194	RME0878	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 195	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 196	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 201	RME0890	R, Met. Chip	1/8W	15kΩ	±5%	1
R 202	RME0890	R, Met. Chip	1/8W	15kΩ	±5%	1
R 205	RME0875	R, Met. Chip	1/8W	820Ω	±5%	1
R 206	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 207	RME0882	R, Met. Chip	1/8W	3.3kΩ	±5%	1
R 208	RCE0775	R, Carbon	1/4W	3.3kΩ	±5%	1
R 209	RCE0788	R, Carbon	1/4W	39kΩ	±5%	1
R 210	RME0902	R, Met. Chip	1/8W	220kΩ	±5%	1
R 211	RME0886	R, Met. Chip	1/8W	6.8kΩ	±5%	1
R 212	RME0880	R, Met. Chip	1/8W	2.2kΩ	±5%	1
R 213	RME0902	R, Met. Chip	1/8W	220kΩ	±5%	1
R 214	RME0901	R, Met. Chip	1/8W	150kΩ	±5%	1
R 220	RCE0767	R, Carbon	1/4W	680Ω	±5%	1
R 221	RME0880	R, Met. Chip	1/8W	2.2kΩ	±5%	1
R 222	RME0880	R, Met. Chip	1/8W	2.2kΩ	±5%	1
R 223	RME0886	R, Met. Chip	1/8W	10kΩ	±5%	1
R 224	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 225	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 226	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 227	RME0876	R, Met. Chip	1/8W	1.0kΩ	±5%	1
R 228	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 229	RME0878	R, Met. Chip	1/8W	1.5kΩ	±5%	1
R 350	RME1065	R, Metal	1/4W	267Ω	±1%	1
R 351	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 352	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 353	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 354	RME0877	R, Met. Chip	1/8W	1.2kΩ	±5%	1
R 357	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 358	RCE0769	R, Carbon	1/4W	1.0kΩ	±5%	1
R 359	RME0870	R, Met. Chip	1/8W	330Ω	±5%	1
R 360	RME0870	R, Met. Chip	1/8W	330Ω	±5%	1
R 361	RME1368	R, Metal	2W	10kΩ	±5%	1
R 362	RCE0761	R, Carbon	1/4W	220Ω	±5%	1
R 363	RCE0779	R, Carbon	1/4W	6.8kΩ	±5%	1
R 364	RME1368	R, Metal	2W	10kΩ	±5%	1
R 365	RCE0760	R, Carbon	1/4W	180Ω	±5%	1

Symbol	Part Code	Description	A
R 366	RCE0760	R, Carbon 1/4W 180Ω ±5%	1
R 367	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
R 368	RCE0763	R, Carbon 1/4W 330Ω ±5%	1
RV 35	RNE0058	VR, Metal EVN 39C00YB13(1K)	1
RV 51	RNE0070	VR, Metal EVN 39C00YB53(5K)	1
RV 54	RNE0049	VR, Metal EVN 39C00YB12(100)	1
RV 55	RNE0050	VR, Metal EVN 39C00YB52(500)	1
RV 78	RDE0003	VR, Carbon EVH-YK3325B14	1
RV 135	RNE0058	VR, Metal EVN 39C00YB13(1K)	1
RV 155	RNE0050	VR, Metal EVN 39C00YB52(500)	1
RV 178	RDE0003	VR, Carbon EVH-YK3325B14	1
RV 354	RNE0070	VR, Metal EVN 39C00YB53 (5K)	1
S 11	SSR0303	SW, Rotary SRRZ-V086S-20KC (12.5)	1
TR 30	HTK0110	Transistor 2SK332E	1
TR 32	HTC0148	Transistor 2SC458-C-	1
TR 36	HTA0224	Transistor 2SA1029 D	1
TR 51	HTC0148	Transistor 2SC458-C-	1
TR 52	HTC0148	Transistor 2SC458-C-	1
TR 57	HTA0224	Transistor 2SA1029 D	1
TR 92	HTC0148	Transistor 2SC458-C-	1
TR 95	HTC0148	Transistor 2SC458-C-	1
TR 96	HTC0148	Transistor 2SC458-C-	1
TR 130	HTK0110	Transistor 2SK332E	1
TR 132	HTC0148	Transistor 2SC458-C-	1
TR 136	HTA0224	Transistor 2SA1029 D	1
TR 151	HTC0148	Transistor 2SC458-C-	1
TR 152	HTC0148	Transistor 2SC458-C-	1
TR 157	HTA0224	Transistor 2SA1029 D	1
TR 192	HTC0148	Transistor 2SC458-C-	1
TR 195	HTC0148	Transistor 2SC458-C-	1
TR 196	HTC0148	Transistor 2SC458-C-	1
TR 208	HTC0148	Transistor 2SC458-C-	1
TR 209	HTC0148	Transistor 2SC458-C-	1
TR 210	HTC0148	Transistor 2SC458-C-	1
TR 221	HTA0224	Transistor 2SA1029 D	1
TR 222	HTA0224	Transistor 2SA1029 D	1
TR 353	HTC0148	Transistor 2SC458-C-	1
TR 354	HTC0148	Transistor 2SC458-C-	1
TR 359	8354929	Transistor 2SC507Y	1
TR 360	8354929	Transistor 2SC507Y	1
TR 365	8354929	Transistor 2SC507Y	1
TR 366	8354929	Transistor 2SC507Y	1

◈3◈ SWEEP

Symbol	Part Code	Description	A
R 542	RCE0783	R, Carbon 1/4W 15.kΩ ±5%	1
R 543	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 544	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 801	RME0890	R, Met. Chip 1/8W 15kΩ ±5%	1
R 802	RME0890	R, Met. Chip 1/8W 15kΩ ±5%	1
R 803	RME0878	R, Met. Chip 1/8W 1.5kΩ ±5%	1
R 806	RME0884	R, Met. Chip 1/8W 4.7kΩ ±5%	1
R 807	RME0887	R, Met. Chip 1/8W 8.2kΩ ±5%	1
R 809	RME0864	R, Met. Chip 1/8W 100Ω ±5%	1
R 810	RME1069	R, Metal 1/4W 562Ω ±1%	1
R 811	RME1069	R, Metal 1/4W 562Ω ±1%	1
R 812	RME0868	R, Met. Chip 1/8W 220Ω ±5%	1
R 813	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R 814	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 815	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 816	RMR3728	R, Metal 1W 47kΩ ±5%	1
R 817	RMR3728	R, Metal 1W 47kΩ ±5%	1
R 901	RME0888	R, Met. Chip 1/8W 10kΩ ±5%	1
R 902	RME0888	R, Met. Chip 1/8W 10kΩ ±5%	1
R 903	RCR3420	R, Carbon 1/4W 180Ω ±5%	1
R 904	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1103	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R 1106	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1107	RCE0775	R, Carbon 1/4W 3.3kΩ ±5%	1
R 1108	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1109	RCE0779	R, Carbon 1/4W 6.8kΩ ±5%	1
R 1110	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1111	RCE0777	R, Carbon 1/4W 4.7kΩ ±5%	1
R 1112	RCE0773	R, Carbon 1/4W 2.2kΩ ±5%	1
R 1113	RCE0780	R, Carbon 1/4W 8.2kΩ ±5%	1
R 1115	RCE0781	R, Carbon 1/4W 10kΩ ±5%	1
R 1116	RCE0767	R, Carbon 1/4W 680Ω ±5%	1
R 1117	RCE0764	R, Carbon 1/4W 390Ω ±5%	1
R 1130	RME0880	R, Met. Chip 1/8W 2.2kΩ ±5%	1
R 1131	RME0880	R, Met. Chip 1/8W 2.2kΩ ±5%	1
R 1201	RME0884	R, Metal 1/8W 4.7kΩ ±5%	1
R 1202	RME1081	R, Metal 1/4W 5.62kΩ ±1%	1
R 1204	RME1119	R, Metal 1/4W 1.15kΩ ±1%	1
RV 420	RDE0003	VR, Carbon EVH-YK3325B14	1
RV 517	RNE0070	VR, Metal EVN 39C00YB53(5K)	1
RV 540	RNE0068	VR, Metal EVN 49C00YB14(10K)	1
RV 541	RNE0068	VR, Metal EVN 49C00YB14(10K)	1
RV 801	RDE0003	VR, Carbon EVH-YK3325B14	1
RV 802	RNE0051	VR, Metal EVN 39C00YB14(10K)	1
RV 803	RNE0058	VR, Metal EVN 39C00YB13(1K)	1
RV 1030	RNE0055	VR, Metal EVN 39C00YB25(200K)	1
RV 1106	RNE0052	VR, Metal EVN 39C00YB23(2K)	1
RV 1112	RNE0052	VR, Metal EVN 39C00YB23(2K)	1
RV 1130	RNE0050	VR, Metal EVN 39C00YB52(500)	1
RV 1131	RNE0050	VR, Metal EVN 39C00YB52(500)	1
S 501	SSR0302	SW, Rotary SRRZ-V046N-20KC (12.5)	1
TR 421	HTC0192	Transistor 2SC641K-C	1
TR 422	HTC0192	Transistor 2SC641K-C	1
F 1102	EFZ0012	IC Protect ICP-F75 (2.7A)	1
F 1130	EFZ0013	IC Protect ICP-F10 (0.4A)	1
F 1131	EFZ0013	IC Protect ICP-F10 (0.4A)	1
IC 510	ILT0037	IC, Analog TL081CP	1
IC 801	ILT0037	IC, Analog TL081CP	1

Symbol	Part Code	Description	A
IC 1106	ILH0088	IC, Analog HA17741PS	1
P 501	JBX2093	Connector 1-164713-2 (8440219)	1
P 502	JBB0027	Connector B2B-XH-A	1
P 503	JBB0021	Connector B3B-XH-A	1
P 801	JBB0021	Connector B3B-XH-A	1
P 901	JBB0021	Connector B3B-XH-A	1
P 1101	JBB0022	Connector B6B-XH-A	1
P 1102	JBB0027	Connector B2B-XH-A	1
P 1103	JBB0028	Connector B4B-XH-A	1
P 1104	JBB0021	Connector B3B-XH-A	1
P 1201	JBB0027	Connector B2B-XH-A	1
R 421	RME0900	R, Met. Chip 1/8W 100kΩ ±5%	1
R 422	RME0896	R, Met. Chip 1/8W 47kΩ ±5%	1
R 423	RME0888	R, Met. Chip 1/8W 10kΩ ±5%	1
R 424	RME0889	R, Met. Chip 1/8W 12kΩ ±5%	1
R 425	RCE0770	R, Carbon 1/4W 1.2kΩ ±5%	1
R 426	RCE0787	R, Carbon 1/4W 33kΩ ±5%	1
R 427	RCE0765	R, Carbon 1/4W 470Ω ±5%	1
R 428	RME0887	R, Met. Chip 1/8W 8.2kΩ ±5%	1
R 501	RCE0797	R, Carbon 1/4W 220kΩ ±5%	1
R 502	RME0882	R, Met. Chip 1/8W 3.3kΩ ±5%	1
R 503	RME0885	R, Met. Chip 1/8W 5.6kΩ ±5%	1
R 504	RME1079	R, Metal 1/4W 3.92kΩ ±1%	1
R 505	RME1080	R, Metal 1/4W 4.75kΩ ±1%	1
R 506	RME1084	R, Metal 1/4W 10.0kΩ ±1%	1
R 507	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R 508	RME0892	R, Met. Chip 1/8W 22kΩ ±5%	1
R 509	RCE0769	R, Carbon 1/4W 1.0kΩ ±5%	1
R 510	RME0887	R, Met. Chip 1/8W 8.2kΩ ±5%	1
R 511	RME1082	R, Metal 1/4W 6.81kΩ ±1%	1
R 512	RME0891	R, Met. Chip 1.8W 18kΩ ±5%	1
R 513	RME1370	R, Metal 1/4W 3.01kΩ ±1%	1
R 514	RME1077	R, Metal 1/4W 2.67kΩ ±1%	1
R 516	RME0892	R, Met. Chip 1/8W 22kΩ ±5%	1
R 517	RME0888	R, Met. Chip 1/8W 10kΩ ±5%	1
R 518	RME0891	R, Met. Chip 1/8W 18kΩ ±5%	1
R 530	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 531	RME1095	R, Metal 1/4W 82.5kΩ ±1%	1
R 532	RME1195	R, Metal 1/4W 110kΩ ±1%	1
R 533	RME1090	R, Metal 1/4W 33.2kΩ ±1%	1
R 534	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 535	RME1262	R, Metal 1/4W 90.9kΩ ±1%	1
R 536	RME1195	R, Metal 1/4W 1.0kΩ ±1%	1
R 537	RME1127	R, Metal 1/4W 6.19kΩ ±1%	1
R 538	RME1168	R, Metal 1/4W 500kΩ ±0.5%	1
R 539	RME1165	R, Metal 1/4W 180kΩ ±0.5%	1
R 540	RME1195	R, Metal 1/4W 110kΩ ±1%	1
R 541	RME1238	R, Metal 1/4W 24.9kΩ ±1%	1
C 420	CEC0424	C, AL Elyc 50V 0.47μF NP	1
C 423	CCG0139	C, Cer. Chip 50V 47 pF ±5%	1
C 501	CCG0134	C, Cer. Chip 50V 27 pF ±5%	1
C 505	CCG0139	C, Cer. Chip 50V 47 pF ±5%	1
C 530	CQE0116	C, Plastic ECQ-E1474JN(JNB) Type-1	1
C 531	CQE0107	C, Plastic ECQ-K1223GZ (100V 0.022μF)	1
C 532	CQE0117	C, Plastic ECQ-P1102JZ (100V 0.001MF)	1
C 533	CES0038	C, AL Elyc 50V 2.2MF ±20%	1
C 534	CQA0124	C, Plastic 50V 0.1μF ±10%	1
C 535	CQA0125	C, Plastic 50V 4700 pF ±10%	1
C			

Symbol	Part Code	Description	A
C 805	CCG0130		1
C 812	CQA0117	C, Plastic 50V 1000 pF ±10%	1
C 1030	CCD0287	C, Ceramic 500V 4700 pF +100 −0%	1
C 1102	CES0326	C, AL Elyc 25V 2200μF	1
C 1106	CQA0127	C, Plastic 50V 10000 pF ±10%	1
C 1108	CES0039	C, AL Elyc 50V 4.7MF ±20%	1
C 1109	CCG0143	C, Cer. Chip 50V 100 pF ±5%	1
C 1114	CES0258FY	C, AL Elyc 25V 470μF ±20%	1
C 1115	CEX0230	C, AL Elyc 50V 1μF BP	1
C 1120	CES0033	C, AL Elyc 25V 100MF ±20%	1
C 1121	CES0033	C, AL Elyc 25V 100MF ±20%	1
C 1124	CES0201FY	C, AL Elyc 160V 47μF	1
C 1126	CES0035	C, Cer. Chip 50V 18 pF ±5%	1
C 1130	CES0033	C, AL Elyc 25V 100MF ±20%	1
C 1131	CES0033	C, AL Elyc 25V 100MF ±20%	1
C 1132	CES0033	C, AL Elyc 25V 100MF ±20%	1
C 1133	CES0033	C, AL Elyc 25V 100MF ±20%	1
C 1202	CCC1034	C, Ceramic 50V 68 pF ±5%	1
C 1204	CQA0117	C, Plastic 50V 1000 pF ±10%	1
D 502	HDX0055	Diode 1SS165	1
D 510	HDM0051	Diode MA161	1
D 511	HDM0051	Diode MA161	1
D 802	HDS0437	Diode 1SS133	1
D 803	HDS0437	Diode 1SS133	1
D 806	HDM0140	Diode MTZ 4.7JB	1
D 807	HDM0140	Diode MTZ 4.7JB	1
D 902	HDS0437	Diode 1SS133	1
D 903	HDS0437	Diode 1SS133	1
D 904	HDM0144	Diode MTZ 22JD	1
D 905	HDM0144	Diode MTZ 22JD	1
D 1102	HDS0437	Diode 1SS133	1
D 1103	HDM0140	Diode MTZ 4.7JB	1
D 1105	HDS0546	Diode SB10-05H	1
D 1106	HDS0546	Diode SB10-05H	1
D 1107	HDS0546	Diode SB10-05H	1
D 1108	HDS0546	Diode SB10-05H	1
D 1109	HDH0046	Diode HZ9B (Zener)	1
D 1110	HDM0140	Diode MTZ 4.7JB	1
D 1112	HDM0141	Diode MTZ 7.5JC	1
D 1120	HDS0437	Diode 1SS133	1
D 1121	HDS0437	Diode 1SS133	1
D 1122	HDS0476	Diode S5566J	1
D 1123	HDS0476	Diode S5566J	1
D 1124	HDS0476	Diode S5566J	1
D 1125	HDS0476	Diode S5566J	1
D 1126	HDV0019	Diode V06C	1
TR 501	HTC0148	Transistor 2SC458-C-	1
TR 502	HTC0148	Transistor 2SC458-C-	1
TR 508	HTC0192	Transistor 2SC641K-C	1
TR 510	HTC0148	Transistor 2SC458-C-	1
TR 515	HTC0148	Transistor 2SC458-C-	1
TR 516	HTC0148	Transistor 2SC458-C-	1
TR 810	HTC0669	Transistor 2SC2912S	1
TR 811	HTC0669	Transistor 2SC2912S	1
TR 813	HTC0148	Transistor 2SC458-C-	1
TR 902	HTC0315	Transistor 2SC1515K	1
TR 1109	HTC0148	Transistor 2SC458-C-	1
TR 1111	HTC0148	Transistor 2SC458-C-	1
TR 1112	HTC0148	Transistor 2SC458-C-	1
TR 1130	HTC0057	Transistor 2SC1213-C-	1
TR 1131	HTA0085	Transistor 2SA673-C-	1
TR 1201	HTA0099	Transistor 2SA781K	1

④ CRT

Symbol	Part Code	Description	A
J 1001	8390152	Socket 1339	1

⑤ HV Z AMP

Symbol	Part Code	Description	A
C 1021	CCD0231	C, Ceramic 2000V 4700pF $^{+80}_{-20}$%	1
C 1022	CCD0231	C, Ceramic 2000V 4700pF $^{+80}_{-20}$%	1
C 1024	CQX0163	C, Plastic 400V 0.1μF ±20%	1
C 1025	CCD0231	C, Ceramic 2000V 4700pF $^{+80}_{-20}$%	1
C 1027	CCD0246	C, Ceramic 2kV 1000pF ±10%	1
C 1030	CCD0336	C, Ceramic DE0707B221K2kV	1
D 1021	HDY0031	Diode Y10GA	1
D 1022	HDY0031	Diode Y10GA	1
P 548	JBS0032	Connector S2B-XH-A	1
P 1020	JBS0023	Connector S6B-XH-A	1
R 548	RCE0772	R, Carbon 1/4W 1.8kΩ ±5%	1
R 1019	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1020	RMR3858	R, Metal 0.5W 3.3MΩ ±5%	1
R 1021	RMR3858	R, Metal 0.5W 3.3MΩ ±5%	1
R 1023	RMV0010	R, Metal VR37 2.2MΩ ±5%	1
R 1025	RCE0786	R, Carbon 1/4W 27kΩ ±5%	1
R 1026	RCE0785	R, Carbon 1/4W 22kΩ ±5%	1
R 1027	RCE0793	R, Carbon 1/4W 100kΩ ±5%	1
R 1028	RMR2782	R, Metal 1W 10kΩ ±5%	1
RV 548	RDV0156	VR, Carbon V16M5-1S10SB 10kΩ	1
RV 1022	RDV0087	VR, Carbon V16M5-1N10SB 1MΩ	1
RV 1024	RDV0089	VR, Carbon V16M5-1N10SB 500kΩ	1

⑥ SW1

Symbol	Part Code	Description	A
D 1116	HDS0451	Diode SLP-530D	1
S 201	SSV0056	SW, Slide SSB0239(2) L=6 NS PCB	1
S 1101	SSV0171	SW, Slide SSB022 Power L6 NS	1

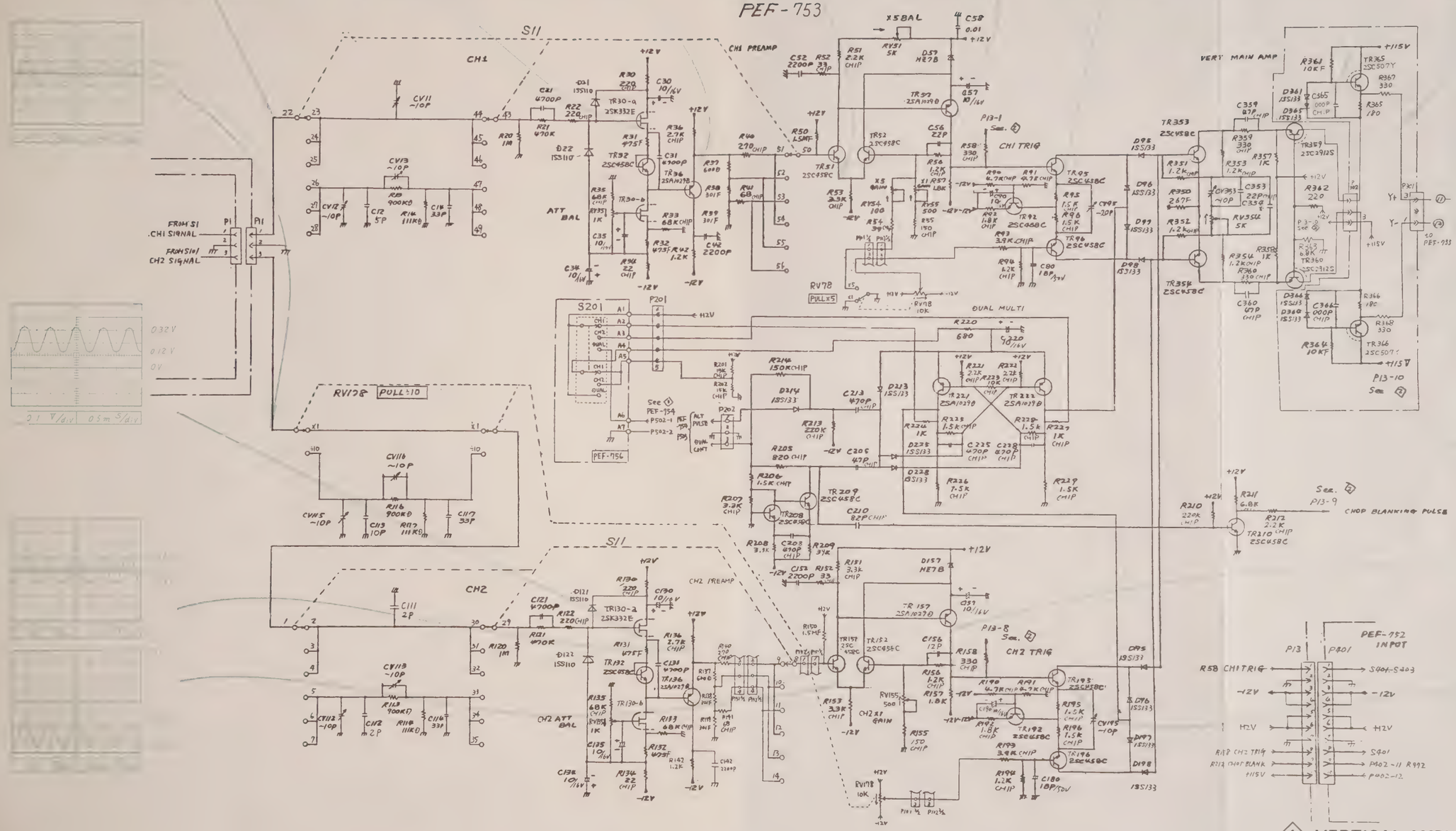
⑦ SW2

Symbol	Part Code	Description	A
S 1102	SSV0171	SW, Slide SSB022 Power L6 NS	1
EOJ G1J600			21,28,46 Duration 00.06.07

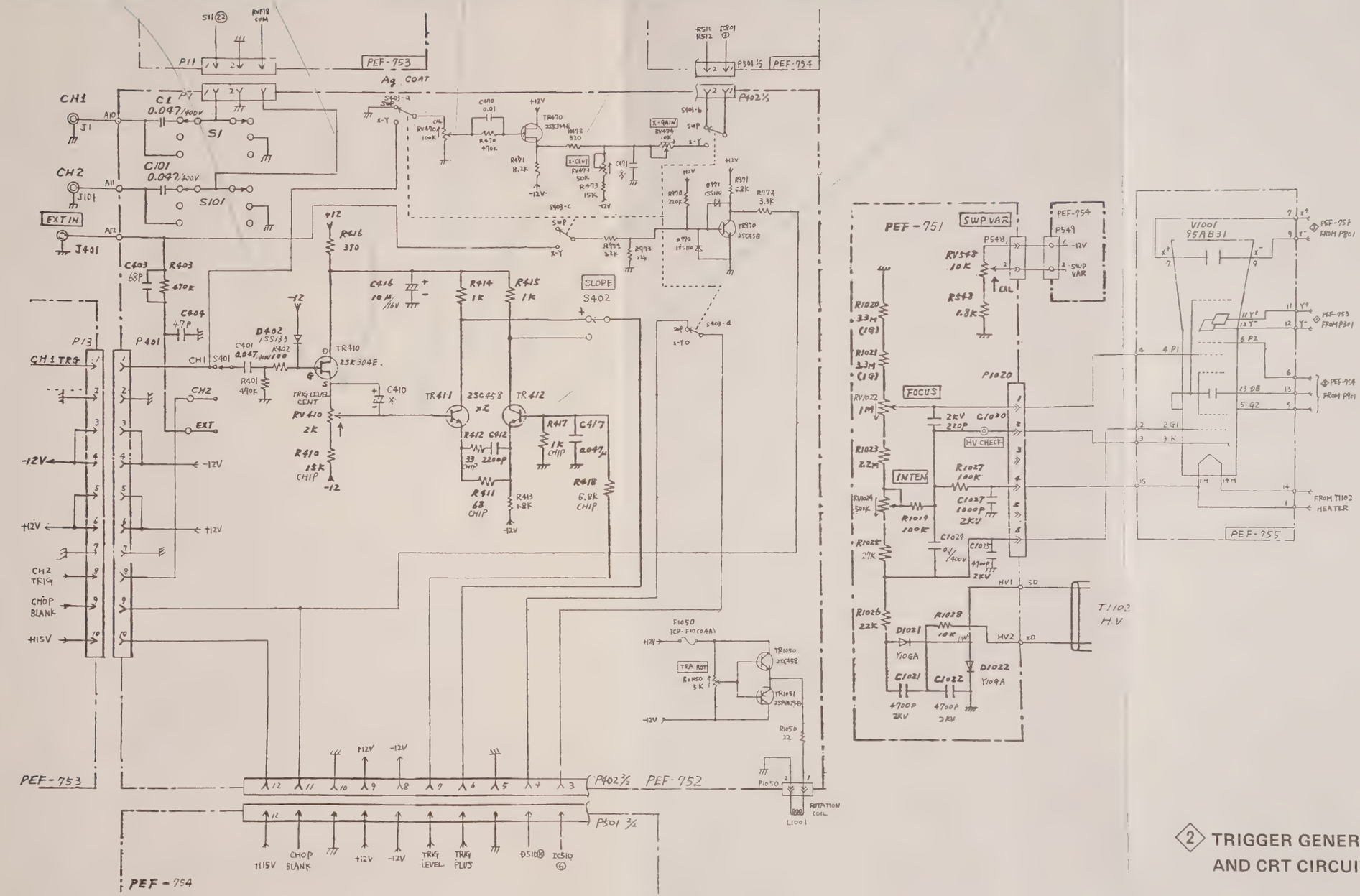
CHASSIS

Symbol	Part Code	Description	A
V 1001	DPX0010	CRT 95AB31	1
	8338351	Terminal Z-048 (Earth)	1
J 1	JHB0088	Coax. Con BNC071	1
J 101	JHB0088	Coax. Con BNC071	1
J 401	JHB0088	Coax. Con BNC071	1
J 1103	JMR0261	Connector R03-R6M	1
J 1201	8397022	Test Point Z069	1
TR 1102	HTB0130	Transistor 2SB942AP	1
T 1102	8193941-44	XFMR Converter	1

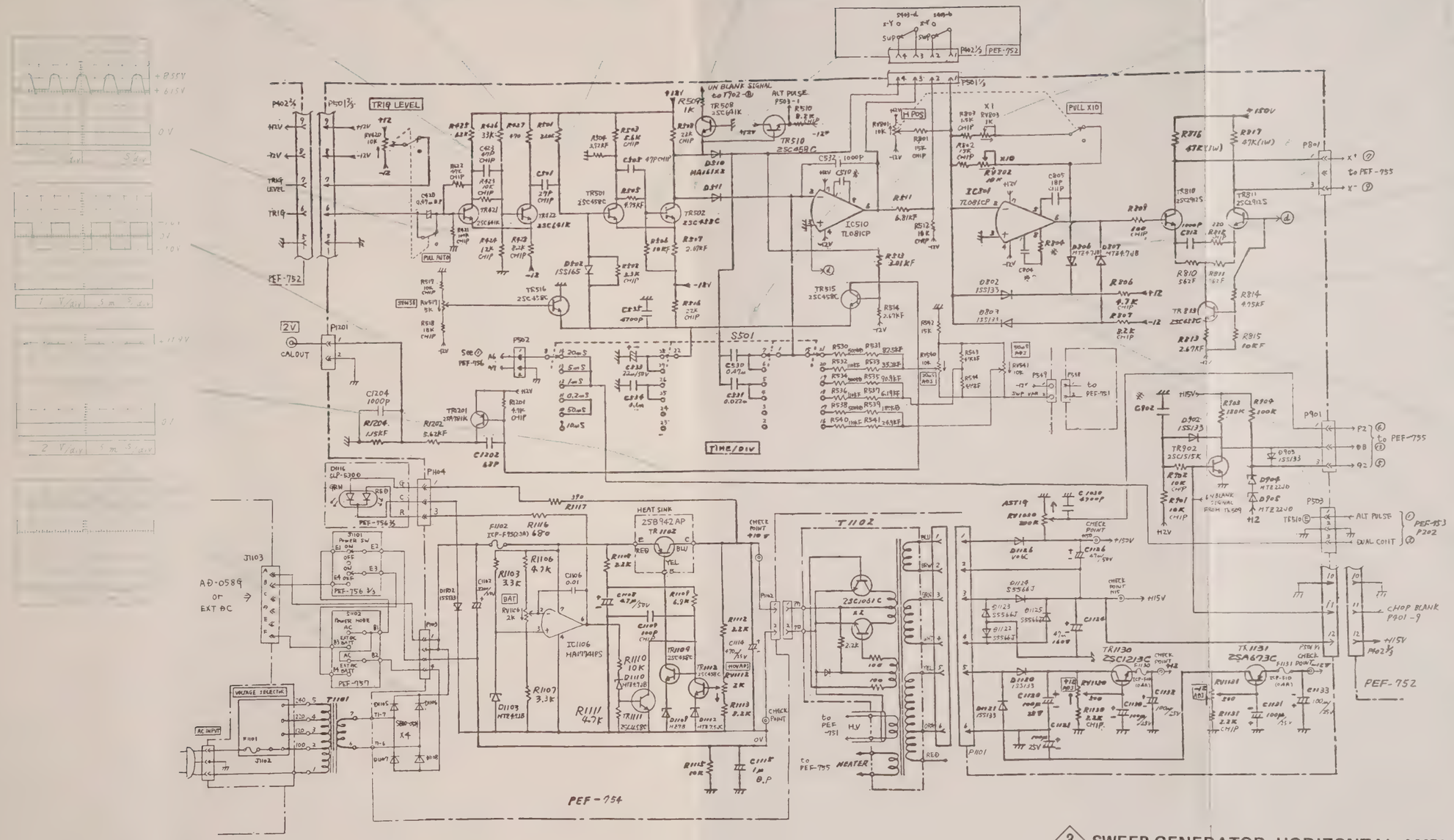
8. SCHEMATIC DIAGRAMS



1 VERTICAL AMPLIFIER



② TRIGGER GENERATOR AND CRT CIRCUIT

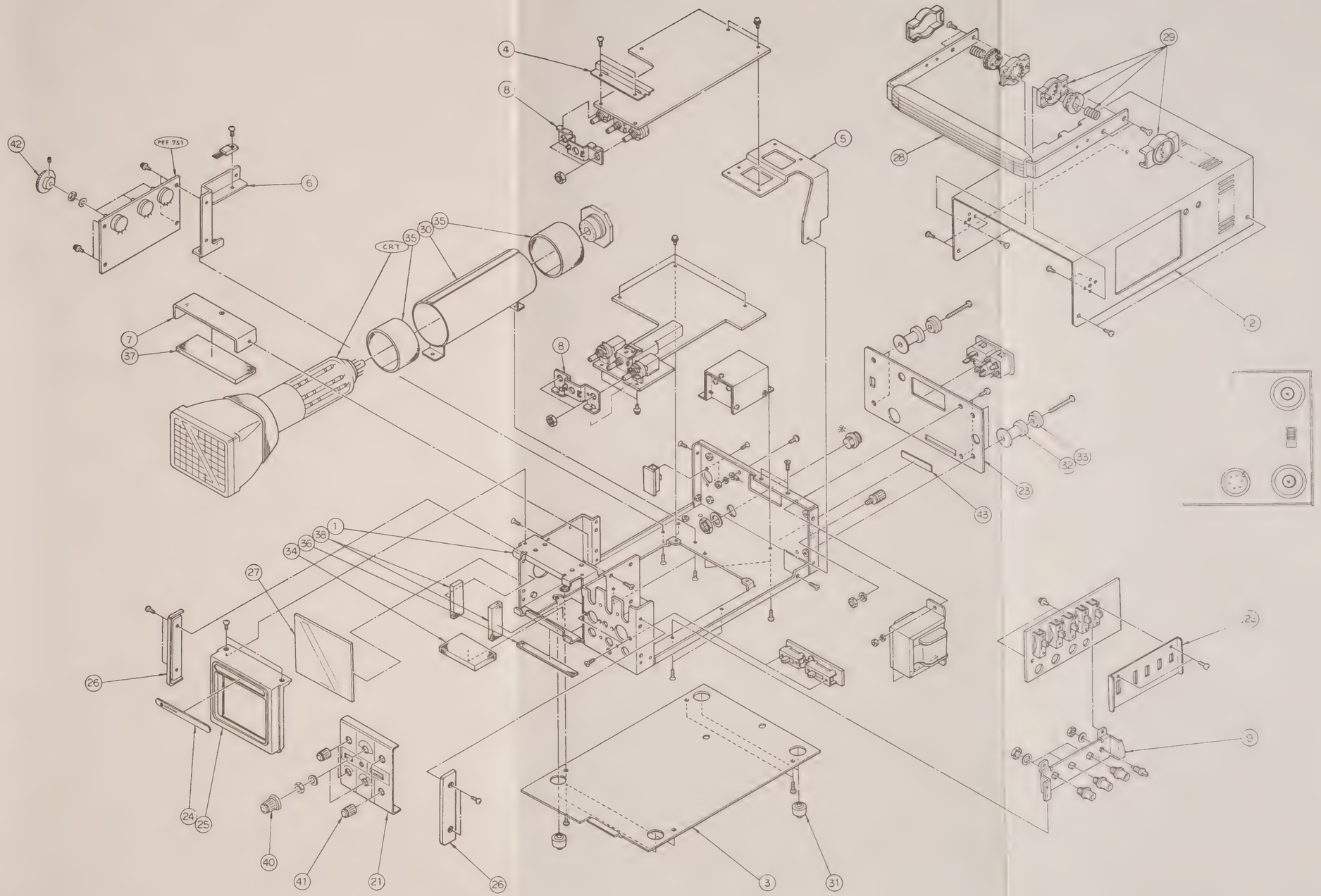


3 SWEEP GENERATOR, HORIZONTAL AMPLIFIER AND POWER SUPPLY.

9. MECHANICAL PARTS LIST AND EXPLODED VIEW

V-058G

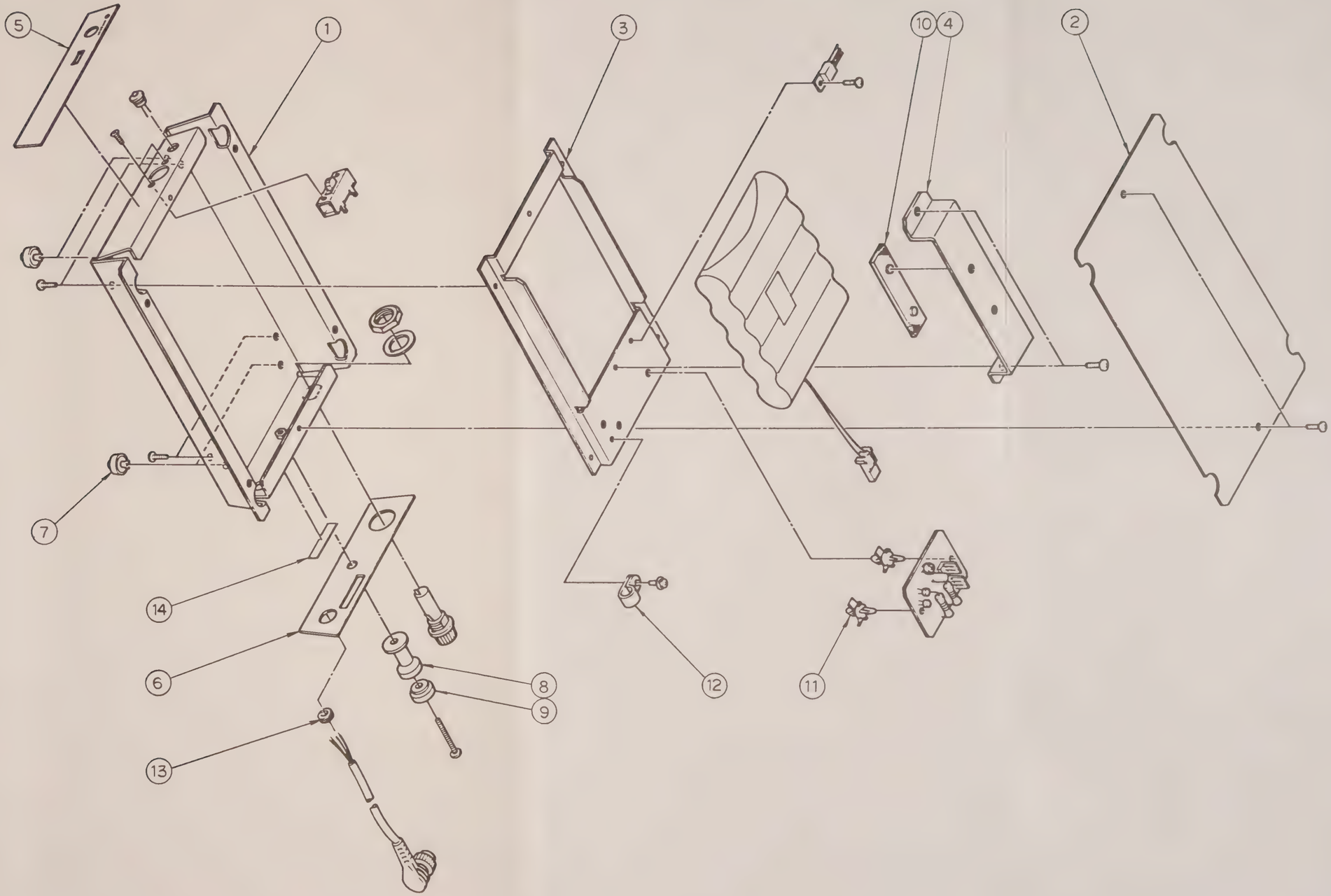
Symbol	Part Code		Qty	Remarks
G01	8463412A	Chassis Assy	1	
1	3203764AA	Chassis	1	
34	8456975A	Rubber	1	
36	8456976C	Cushion	1	
38	8456976E	Cushion	2	
2	3202152A	Cover, up	1	
3	8456413A	Cover, bottom	1	
4	8456371A	Bracket	1	
5	8461139A	Bracket	1	
6	8461140A	Bracket	1	
G02	8463414A	Bracket Assy	1	
7	8461141A	Bracket	1	
37	8456976D	Cushion	1	
8	8454750A	Bracket	2	
9	8454749A	Bracket	1	
21	8456373A	Panel, front	1	
22	8456374A	Panel, side	1	
23	3202199A	Panel, rear	1	
G03	8463416A	Bezel Assy	1	
25	3122738B	Bezel	1	
24	8456973A	Nameplate	1	
26	8279834B	Frame, side	2	
27	8456974A	Filter	1	
28	8454738A	Handle	1	
29	8453355A	Stopper, handle	2	
G04	8463418A	Shield case Assy, CRT	1	
30	8456375A	Shield case	1	
35	9456976A	Cushion	2	
31	8459530B	Foot, bottom	4	
32	8114110A	Foot, rear	4	
33	8145689A	Foot cushion, rear	4	
40	3149321A	Knob	2	
41	3149324B	Knob	4	
42	8456977A	Knob, side	3	
301		Screw, sems	11	M3 x 8
302		Screw, sems	4	M2 x 5
303		Screw, sems	2	M2.6 x 3
304		Screw, black	6	M2.6 x 6
305		Screw	17	M3 x 8
306		Screw	1	M4 x 8
307		Screw, flat	16	M2.6 x 4
308		Screw, flat	4	M4 x 8
309		Screw, pan	4	M4 x 35


PEF 751
CRT

10. MECHANICAL AND EXPLODED VIEW (AD-058G)

AD-058G

Symbol	Part Code		Qty	Remarks
1	2118147AA	Chassis	1	
2	8461151A	Cover	1	
3	3204822AA	Bracket	1	
4	8461152A	Bracket	1	
5	8461154A	Panel, front	1	
6	8461155A	Panel, rear	1	
7	8459530A	Foot, bottom	4	
8	9114110A	Foot, rear	1	
9	8145689A	Foot cushion, rear	1	
10	8377074A	Rubber	1	
11	8360723A	Support	2	LCBS-3NS
12	4124935C	Clamp	1	HP-4N
13	ERR0015	Bush	1	NG-79-C
301		Screw, sems	1	M3 x 8
302		Screw	7	M3 x 8
303		Screw	2	M4 x 8
304		Screw, pan	1	M4 x 35
305		Screw, flat	2	M2.6 x 4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